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# D4.2 – Development of a monetary value scale in MIMES

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| **PU** | Public | |
| **CO** | Confidential, only for members of the consortium (including the Commission Services) | X |


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## Document history

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# Glossary

| Acronym | Full name |
|---|---|
| **CE** | Choice experiment |
| **cLCC** | conventional (or financial) Life Cycle Costing |
| **CS** | Consumer surplus |
| **CV** | Contingent valuation |
| **EC** | European Commission |
| **eLCC** | environmental Life Cycle Costing |
| **ES** | Ecosystem Service(s) |
| **FU** | Functional Unit |
| **GDP** | Gross Domestic Product |
| **GI** | Green Infrastructure |
| **IRR** | Internal Rate of Return |
| **LCA** | Life Cycle Assessment |
| **LCC** | Life Cycle Costing |
| **LCSA** | Life Cycle Sustainability Assessment |
| **LID** | Low Impact Development |
| **MAES** | Mapping and Assessment of Ecosystems and their Services |
| **MIMES** | Multiscale Integrated Modelling of Ecosystem Services |
| **NBS** | Nature-based Solutions |
| **NPV** | Net Present Value |
| **PBP** | Pay Back Period |
| **PS** | Producer Surplus |
| **PVB** | Present Value of Benefit |
| **PVC** | Present Value of Costs |
| **SDM** | System Dynamics Model |
| **sLCC** | Societal Life Cycle Costing |
| **TEEB** | The Economics of Ecosystems and Biodiversity |
| **TEV** | Total Economic Value |
| **UC** | Urban Challenge |
| **UES** | Urban Ecosystem Service(s) |
| **USC** | Urban Sub-Challenge |
| **UN** | United Nations |
| **WFD** | Water Framework Directive |
| **WP** | Work Package |
| **WTA** | Willingness to Accept |
| **WTP** | Willingness to Pay |


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# Executive Summary

To support policy and decision-making on Nature-based Solutions (NBS), it becomes of primary importance integrating the economic dimension variable in the sustainability analysis of such systems, in order to take into account the trade-offs and weight costs and benefits with a common (monetary) unit. Starting from these considerations, the Nature4Cities team of the Task 4.2 developed a monetary value scale to better inform the planning and design process for NBS implementation according to the use of a system dynamics framework based on the Multiscale Integrated Model of Ecosystem Services (MIMES).

The work illustrated in this Deliverable 4.2 (D4.2) thus represents the practical follow up of the methodological framework proposed in the previous Task 4.1 of Nature4Cities for modelling urban ecosystem services (UES) associated with NBS. Building on the MIMES work proposed there, the team of the Task 4.2 defined a quantification approach for establishing a monetary value scale that takes into account costs and benefits derived from urban NBS, allowing to evaluate the net societal benefit that can be generated out of their implementation. This monetary value scale was validated with a proof of concept model of urban forest applied to a case study in Madrid (Valdebebas Park), Spain. As a result of an extensive literature review and modelling exercise, many advantages, some limitations and the future activities required to improve such a monetary value scale were identified.

The investigation of the literature suggests that the most studied practice for NBS implementation does not always turn out to be the most economically desirable one. However, once cost effectiveness is evaluated properly, the NBS investigated in the literature can become economically attractive. This is because the costs of an NBS system shall be accounted for the entire duration of the NBS life cycle, allowing to capture a more exhaustive picture of the economic flows associated with an NBS. In this regard, life cycle costs are typically represented by all the financial flows associated with the design, investment, implementation, use, management and possible end-of-life phases of the NBS, as well as by the external costs internalized or expected to be internalized in the near future. An approach based on life cycle costing can thus allow to handle the monetarization of impacts associated with externalities when operating the NBS, being either positive or negative. In this regard, NBS do essentially provide benefits to the society in terms of urban ecosystem services (UES), which can be accounted for by means of several monetary valuation techniques.

A benefit transfer approach was selected after this literature review as the most appropriate way to monetarise the physical output from an NBS-MIMES model. By applying this approach to the simulation outputs of the Valdebebas Park NBS model, a proof-of-concept was made for the development of a monetary value scale for NBS-MIMES models in Nature4Cities. This proof of concept model eventually provides an illustrative example of dynamic simultaneous accounting


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of three UES (wood provision, carbon sequestration and temperature regulation), two management costs (treatment of plant residues, and replanting), and investment costs for urban forests in a detailed spatial (100 m2) and temporal (modelling by month, later aggregated by year) resolution.

Next future efforts of the Nature4Cities team developing integrated NBS models for UES valuation will be dedicated to tailoring the advancement and application of such an urban forest model to other areas in Europe, depending on the availability of data. Moreover, the quantification functions and monetary valuation properties of this model will be incorporated into the socio-economic assessment module of the Nature4Cities Platform, which will be further expanded with test-bed cases by designing, constructing and implementing additional system dynamics based MIMES-NBS models.

The proof of concept model developed in the Task 4.2 of Nature4Cities shows that it is possible to develop a methodology, and validates its analytical framework, to characterize NBS and assess their cost-effectiveness, taking into account both benefits, co-benefits and possible negative impacts. The study illustrated in the present deliverable D4.2 also highlights that a widespread lack of context and dependence on the environment and economic knowledge. This implies that the need to rely on site-specific data is, once again, reflected in the development of such complex modelling and decision support systems. Nevertheless, with the work performed in this Nature4Cities task, the team further proves that the design and application of a systemic thinking is very promising to foster the multi-stakeholder involvement through participatory processes, whereby more evidence on NBS cost-effectiveness made available with the use of monetary value scales (as proposed in this report) might support the system integration of NBS into a sustainable urban planning.


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